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ABSTRACT

This study was conducted to examine the contribution that a knowledge management system (KMS) makes to individual learning in an organizational setting. Open-ended survey questions were used to collect data to help us understand user perceived system quality, information quality, and organizational conditions, which are believed to enhance the degree of KMS use in the respondents' organizational contexts. This study found that KMS use benefits learning in a variety of ways. In addition, daily job performance, training, and personal conversation were all found to have influenced the levels of individual learning.

Keywords

Organizational learning, individual learning, knowledge management system, system quality, information quality

INTRODUCTION

The concept of organizational learning is believed to be critical in the transformation of organizations so that they will be competitive in the new millennium. Swieringa and Wierdsma (1992) define organizational learning (OL) as a collective learning process that "takes place in and through interaction with and between a number of people" (p. 33), aiming to generate a mutual behavioral change toward organizational improvement or radical renewal, so that the organization can survive and/ or outperform its competition. Because of the causal relationship between organizational learning and an organization's survival and competitiveness, it becomes important for the organization to learn.

THEORETICAL BACKGROUND

Organizational Learning

Huber (1991) considers organizational learning as an information-processing process that includes acquiring, interpreting, distributing, and storing of information/knowledge, with organizational memory as its product and where all the processed information/knowledge resides. Klimecki and Lassleben (1998) conceptualize OL as a communication-based process where the organization overcomes its previous boundaries of knowledge and ability, allowing its members to share knowledge, interact and influence each other, and cope with difficult situations. Combining these two perspectives, Nonaka and Takeuchi (1995) see OL involving the generation, absorption and sharing of tacit knowledge, and they emphasize the importance of interaction among people towards the development of OL capability.

Individual Learning

All learning takes place in individuals (Dixon, 1999), who are the agents of organizational learning. Even though organizations learn only through the experiences and actions of individuals (Argyris and Schön, 1978), "organizational learning is not simply the sum of each member's learning" (Fiol and Lyles 1985, p. 804). Organizations have memories, which preserve certain behaviors, mental maps, norms, and values over time. This study focuses on the individual as the unit of analysis, exploring individual learning within the context of organizational conditions and processes.

Knowledge Management (KM), Knowledge Management System (KMS), and KMS Use

Knowledge is defined as the state of knowing and understanding (Alavi and Leidner, 2001). Organizational knowledge represents an organization's intellectual asset, and is necessary to organizational learning and adaptation (Duncan and Weiss, 1979). Researchers and practitioners have argued that learning can be enhanced through knowledge management. Senge (1990) defines learning organizations as groups of people continually enhancing their capacity to create what they want to create. Since creation from scratch is time consuming and comes with a cost, a more economic way is through learning from each other's experiences and sharing knowledge with one another so as to cut down the expenses of reinvention. Under this context, knowledge management systems (KMS) have been promoted by IS researchers as a class of information systems used to support creation, storage/retrieval, and transfer of knowledge in organizations (Alavi and Leidner, 2001).

It has been emphasized that the value of an information system is based not so much in the product itself, but in its effective and efficient usage (Kremers and van Dissel, 2000). Tiwana (2000) suggests that companies that used their implemented KM technology were ones that prospered.

Research on system use is focused either on the "use of the *system/ technology* itself" or on the "utilization of the system *outputs*." KMS use in this study combines these two, and defines KMS use as system utilization and knowledge application. Based on this, a KMS can make a difference only if the system is utilized[1] to enhance the application and reuse of knowledge so as to enhance individual learning in the organization's context.

System Quality

The degree of system use is greatly influenced by system quality (Jennex and Olfman, 2002). It makes practical sense to state that when an information system is easy to maintain, adapts to changes flexibly, as well as performs its functions reliably, consistently, predictably and efficiently, people will tend to use the system more. Alavi and Leidner (2001) urge that an organization's KMS should allow its workers to find a domain expert or locate needed knowledge. In addition to one-way search and passive information distribution, KMS should also support two-way dialogue and be utilized as a discussion forum for problem solving and for better decision-making. It is believed that KMSs with a well-ordered scheme of reference support a more effective and efficient search than those without (Groom and Groom, 2002); with text mining techniques enable deep search, and effective exploitation of an organization's knowledge; and with online directories allow both people to people interaction and people to document search (Simpson, 2002). This study evaluated perceived KMS quality based on the abovementioned functions.

Information Quality

Huber (1991) claims that more organizational learning occurs when more of the organization's components obtain knowledge and recognize it as potentially useful. For knowledge/ information to be recognized as useful, so as to be used, it must have a certain degree of quality. In the same manner, only when the transmitted information has high quality, can the matching possibility between the intent and context of the sender and that of the receiver be enlarged. Thus Jennex and Olfman (2002) argue that information quality, like system quality, plays a role in influencing KMS use.

The quality of the information is defined by attributes such as accuracy, precision, level of detail, conciseness, exhaustiveness, completeness, relevance, redundancy, timeliness, currency, reliability, source, and format (Alter, 1999). This study measures perceived information quality based on such attributes.

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[1] KMS system utilization is defined as the degree to which the organization's members use the system as storage, pipeline, and discussion platform.

Organization's Facilitating Conditions

Individuals act as an organization's agents; in turn, organizations facilitate or inhibit individuals' activities as an ecological system. Thompson, Higgins and Howell (1991) argue that technology utilization cannot occur if objective conditions in the environment prevent it, and as such, firms should accommodate facilitating conditions to enhance technology utilization. An integrated approach to KM development has been suggested: "one that addresses not only its technological aspects but also its organizational and process aspects" (Wang and Plaskoff 2002, p. 114). Davenport (1998) urges companies to facilitate system utilization and knowledge sharing and use because they are often unnatural acts. Some form of management support and/or rewards needs to be in place to build a knowledge-sharing environment, and to change people's mindset and behavior to a knowledge-oriented frame (Ichijo, von Krogh, and Nonaka, 1998; Ruggles, 1998). This research postulates that with increased organizational support[2] of KMS use for knowledge sharing and experience transfer, the more frequently an organization's KMS will be used.

Research Objectives and Key Questions

From the above review, the following research questions were derived: 1) whether the use of a KMS enhances learning and to determine the more significant enablers to individual learning at work? 2) What kinds of individual learning occur due to KMS use in an organizational context? 3) In what ways can an organization improve its KMS' quality? 4) In what ways can information/ knowledge in the KMS be improved? 5) What are the facilitating conditions for KMS' system utilization and knowledge application?

RESEARCH METHODOLOGY

Research Design

A survey methodology was used. The survey included both closed-ended (for quantitative analysis) and open-ended (for qualitative analysis) questions. This paper discusses the responses to open-ended questions. Data was gathered through a Web-based survey (principally) and some paper-based surveys.

Sampling Strategy and Data Collection

The population studied was individuals in organizations who have access to information and communication technologies (ICT) and database storage used for knowledge acquisition, organization, storage, and/ or dissemination. The sampling procedure is purposive because it is based on obtaining as many survey responses as possible via personal or referral contact. Respondents were from a number of countries, with the majority coming from the US.

Survey Instrument

The qualitative data collection was based on one rank order and five open-ended questions. Some basic demographic information was also collected, including gender, age, length of time with the organization and in current position, years using KMS, industry employed, job title and function, and the highest education attained.

Factors Enabling Individual Learning at Work

Based on Huber (1991), we argue that in order for OL to occur, "knowledge must be acquired, distributed in the form of information, interpreted and then retained in some form of organizational memory" (Lambright, 2001, p. 10). Based on the features and functions supported by KMSs, the use of KMS should facilitate effective learning in the organization.

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[2] Organizational support can be in the form of management encouragement, time allowance, or technical support.

Just as the use of a KMS influences an organization's capability to learn, there are many other enablers that can be used by an organization to enhance its capability for productive learning (Argyris and Schön, 1996). Easterby-Smith and Araujo (1999) argue that learning takes place in the interaction between people. In an organization's setting, interaction is made possible through meetings – both formal and informal – and interpersonal conversations, while "learning by doing" is realized when employees are doing their jobs. Question 1 states:

The following is a list of factors that enable people to learn at work. Write in any additional factors, and rank them from most (1) to least important (7).

_____ Using the knowledge management system

_____ Informal meetings

_____ Formal meetings

_____ Personal conversations

_____ Doing your job

_____ Training/Workshops/Seminars

_____ _____

Types of Learning Facilitated by KMS Use

In order to measure whether organizational learning occurs, there needs to be some object that can be measured. Argyris and Schön (1996) assert that "individuals are the only subjects of learning" (p. 188). Based on this, this study focuses on an individual's perceived forms of learning as the parameter of an organization's learning. Therefore, question 2 asks:

What learning occurs due to the use of KMS?

Ways to KMS System Improvement

The criticality of system use is described in Section 2.1, while the correlation between system quality and KMS use is discussed in Section 2.2. As there is no single technology comprising KMS, and since what technologies should be included in KMS are unclear; there is a need to explore the elements perceived as important to KMS system quality, and the means organizations use to improve or strengthen KMS' quality. Question 3 asks:

Can you suggest ways that your Knowledge Management System should/ can be improved? (For example, faster transfer, easier user interface, navigation aids, relevance ratings, etc.)

Ways to Information/ Knowledge Improvement

As discussed in Section 2.3, if the quality of the information/ knowledge that a KMS produces is perceived to be good, it is more likely that individuals would use the system as it benefits their particular needs. There are over 10 attributes proposed by IS researchers as indicators of information quality. However, there exists the possibility of missing attributes, which are important to KMS users but not discussed in the literature. To discover the attributes that are perceived as important to information quality by respondents, and to solicit suggestions so as to find the most salient ways to improve information/ knowledge, question 4 asked:

Can you suggest ways that the information/ knowledge residing in your KMS can be further improved?

Facilitating Conditions to Support KMS Use

As suggested in Section 2.4, to some degree, the level of KMS use is influenced by an organization's conditions. One of purposes of this study is to identify the types of applications that lead to a positive impact on KMS use. Question 5 was therefore included to explore respondents' ideas on organizational practices to enhance the level of KMS use.

Can you suggest ways that your organization can be more supportive of KMS use?

RESEARCH FINDINGS

The findings are organized into four parts.

Methods Used for Data Analysis

A total of 378 data items were collected from the 144 survey takers who responded to the above six questions[3]. Richards and Richards (1998) suggest two approaches to qualitative research: working "up" from data and working "down" from theory. The former approach builds new understanding through exploration of data records, discovery of patterns, and construction of impressions, while the latter incorporates and builds on prior theoretical input, ideas or formal hypotheses. This research uses a combination of these two methods in its data analysis. It starts out with a systematic process of analyzing textual data, and then works down from theory when the pattern of responses was found to be consistent with theoretical findings.

The process of Developing Coding Categories

Following the steps suggested by Tesch (1990), the first author read through the 378 data items, thought about the substance of the information and its underlying meaning, made a list of all topics, clustered together similar topics, abbreviated the topics as codes, found the most descriptive wording for the topics and grouped them into categories. At the end of the coding development process, the responses seemed to fall naturally into a number of categories, most of which were found to be consistent with the theoretically developed construct of measures. Therefore, eight scales that formed the basis for the quantitative data collection: level, form, richness, linkage, encouragement, resources, performance, and changes were used as the coding categories in the analysis and interpretation of the responses. As for the items that did not fall within the eight scales, they were analyzed and depicted as emergent themes and are presented in Section 4.4.

Data Interpretation

Of the respondents, 43 (29.9%) come from the engineering/ manufacturing industry, and 37 (25.7%) come from the consulting/ services industry. Analyst/ programmer/ technician (45.8%) together with managerial/ supervisory category (39.6%) made up the majority of respondents. There are more male representatives (61.1%) than female (38.2%). Most respondents were in their 30s (40.3%) or 40s (30.6%).

Factors Enabling Individual Learning at Work

Doing their job was considered the most important factor for learning, using the knowledge system was the second most important factor, followed by training/ workshops/ seminars, personal conversation, and informal meetings. Formal meetings were the least important factor to learning. Given that training /workshops/seminars was ranked 3rd, it seems that KMS that are enhanced to allow online training would further improve on-the-job learning.

Learning Facilitated by KMS Use: Change and Performance

This study argues that the use of a KMS leads to effective organizational learning. Based on Garvin (1993), organizational learning usually can be traced through three stages: cognitive change, behavioral change, and performance improvement. Our findings are consistent with Garvin's argument, and we therefore use his three-stage learning outcomes as parameters in analyzing organizational learning.

Respondents perceived changes occurring in both cognition and behavior due to KMS use. First, in the area of cognitive change, the knowledge management system enables users to detect troubles and problems, and identify changes. It also grants them greater thinking capabilities in grasping new ideas and technologies, new perceptions of self and other employees, and a new level of understanding of customers. Second, in terms of behavioral change, the KMS allows its users flexibility in task

[3] In the larger study, a total of 360 surveys were completed.

coordination and implementation, and the possibility of developing new markets, products and services. Joint product development, virtual meetings, online learning and training, interactions among colleagues, and active dialogue with customers are all made possible. The KMS also helps with research and development, and enables users to learn "change" and "what not to do". Empowering customers is another benefit of KMS. In addition, access to KMS allows users to switch their focus to more challenging and complex jobs, leverage more effectively, and manage their time much better.

As for performance, the concept of KMS-improved quality is found in enhanced customer service and satisfaction, ameliorated partner/ customer relationships, improved software development and sales, and enhanced documentation support. The identified circumstances where KMSs help in shortening cycle time include system and product development, new requirements adjustment, call handling, decision-making, troubleshooting and solution delivery, and sales processes. Moreover, KMS-enabled virtual meetings also save individuals a lot of traveling time.

Ways to KMS System Improvement: Level and Form

Level is defined as the system's ability in search and retrieval to bring past information to bear upon current activities (Jennex and Olfman, 2002). Among five key concepts within level, completeness of search, ease of search, and speed of retrieval are proposed by Jennex and Olfman (2002) in measuring a KMS's level. The emphasis of effective search should be on the relatedness and usefulness of information retrieved and not the amount retrieved.

Incorporating more tools and functions into a KMS was recommended. Easier user interface, better navigation aids, and fully functional search engines were emphasized. Suggestions such as a better query system with greater ease of data manipulation, keyword/ semantic search, cross-indexing features, information categorization, and content management were made to enhance ease of search. Relevance ratings, quality scores, hit list, and content summary were techniques recommended to make searching more effective.

Form is defined as the extent of the computerization and integration of a KMS. Computerization is used to measure the degree of information/knowledge available online, while integration is meant to assess the extent of incorporation among distinct subsystems. The importance of computerization was emphasized by urging for the inclusion of more information in the knowledge base, including archived meetings, audio clips, presentations, e-mails, real-time news, training courses, X-rays, and medical information. The criticality of integration was highlighted; the problems derived from non-integration were also mentioned. Many respondents suggested building an intranet portal (so called "one-stop shop") to integrate multiple database systems.

While the majority of responses support integration, some give credit to separate systems, and highlight the challenge of pursuing integration. This implies that connectivity and compatibility between systems may be more appropriate for some organizations, for which compatibility among systems seems to work better than integration.

Ways to Information/ Knowledge Improvement: Richness and Linkage

The explicit-tacit knowledge classification is widely cited (Alavi and Leidner, 2001). Explicit knowledge is articulated, and can be encoded and diffused easily. Tacit knowledge, on the contrary, is implicit knowledge embedded in the expertise and experience of individuals. Based on this classification, Jennex and Olfman (2002) create "richness[4]" and "linkage[5]" as two constructs for examining information quality.

Currency was the most mentioned attribute; "get rid of the outdated and keep updating" seems to be especially imperative in the ever-changing business environment. There was no agreement as to how often information should be updated; suggestions included daily, frequently, regularly, on time, continuously, and within 2 days. *Timeliness* is also seen as important; the emphasis is to "deliver the right content to the right people at the right time." While information *completeness/ adequacy*[6] are important, *relevance* is not overlooked by the respondents. The problem with irrelevancy was identified, including time

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[4] Richness consists of a set of attributes used to discern how good the explicit information is.

[5] Linkage contains a set of characteristics utilized to determine the quality of linkage in locating and linking to experts, and in supporting digital spaces for generative conversations on perceptions of organizational events, activities and problems.

[6] Alter (1999) points out the impossibility of having totally complete information. He suggests that information should be considered complete when it is enough for the tasks and situations at hand. Completeness and adequacy are therefore grouped in one category in the discussion.

consumption in sifting through irrelevant information and making sense of nonsensical information. Some respondents suggested that useless information should be eliminated, and relevant and useful information be provided for system users' daily activities.

Sufficiency is another important indicator of information richness. Respondents described situations where information is more than *sufficient*, leading to frustration because of limited time and attention span. Both *understandability* and *contextuality* are considered as important attributes in enhancing information/ knowledge applicability. More details and more commonality of terms and definitions are considered as avenues to understandability. Information with contextuality is seen as an asset and can improve the level of understanding; however, too many details can frustrate users. As for the importance of information *accuracy*, the focus is not only on the correctness of information but also on the integrity and validity of information sources.

KMS supports digital spaces for generative conversations through the provision of Internet-type linkage. Respondents mentioned the importance for a KMS to support electronic platforms for online discussion and to provide a complete and accurate linkage to tacit knowledge.

In addition to emphasizing the importance of linkage, respondents also identify its benefits. Information linkage not only allows for access to a variety of knowledge resources, it also provides expert search and interaction among different parties. This leads to knowledge sharing and collaboration, and experience exchange. Rich information transmission and topic discussions are all made possible through online conversation, which further facilitates knowledge generation, and improves problem solving.

Methods to Support KMS Use: Encouragement and Resources

It is argued that organizational conducive conditions help get rid of the "not invented here" syndrome (O'Dell and Grayson, 1998) and leads to increased KMS use. In the IS literature, facilitating conditions were discussed and measured from the aspect of technical support (Jobber and Watts, 1986; Thompson et al., 1991). The responses from KMS users suggest a variety of methods that can be used by organizations to support KMS use, which can be grouped into two categories: encouragement and resources.

Encouragement can be further classified into three areas: KMS use, knowledge sharing, and online discussion. Respondents emphasized the need for support from top management. There seems to be an agreed-on consensus that organizations should endorse knowledge sharing. The emphasis is not only on leveraging and sharing knowledge, experiences, and best practices, but also on encouraging submission and posting of documents to the knowledge base. Challenges of sharing knowledge across groups were identified. Two approaches to knowledge sharing were suggested: using influential people to publicize the benefits of sharing and building collaboration networks, and having a motivational scheme tied to the compensation structure. As for online discussion, the emphases include encouraging the use of online communication applications, the engagement of online collaboration and cooperation, and the use of discussion groups and communities of practice.

Emergent Themes

Several additional themes emerge from the analyses of open-ended question responses.

1. More training to leverage the utility of the KMS;
2. Boost system use by publicizing benefits of KMS use;
3. A long-haul effort in enhancing system and information quality;
4. Information quality can be improved through KMS use;
5. Providing wide-range system and information accessibility vs. exercising access control;
6. Incorporate publication and learning/ training functions in KMS.

DISCUSSION

A Review of Findings

First, in terms of system level, respondents desired an overall better system with features to enhance search. With regard to system form, integration might not always be the best or the only choice. For some organizations, separate but connective systems with compatibility among them may be more appropriate.

Second, with regards to information richness, currency is the most mentioned attribute of information quality. However, it is unclear from responses how often the knowledge base should be updated. Some respondents noted that there is a cost each time updates are implemented, while others indicated that the cost of not having timely information can be high. In terms of information linkage, respondents recognize both its importance and benefits, such as allowing for access to knowledge resources and interacting with experts, which creates potential for individual learning.

Third, respondents indicated a need to endorse knowledge sharing, and to encourage system utilization and online discussion by providing resources and establishing motivational schemes in the form of monetary incentives, recognition, or acknowledgement. Support from top management was largely emphasized as a facilitating condition to KMS use and thus organizational learning.

Fourth, the analysis found that respondents did perceive changes occurring in both cognition and behavior due to KMS use. KMS use was also found to improve respondents' job performance. Although the survey takers perceive a positive impact of KMS use on their learning, it was noted that while some learning leads to productive outcomes, some results in competency traps, which can occur if obsolete knowledge remains in the knowledge base and is used.

Fifth, "doing one's job" is considered the most important factor for learning, followed by KMS use.

Sixth, other key findings from this study include: (1) bolster system use by publicizing the benefits of KMS use and providing more training; (2) make publication and learning/ training part of KMS functions; (3) improve system and information quality on a constant basis; (4) improve information quality through KMS use; (5) determine the degree of accessibility to the KMS and its contents.

Limitations

The main limitation of this study relates to the nature of sampling. About 30% of respondents were from the engineering and manufacturing industries, for which the quality of a KMS might not be as critical as it is to service-oriented industries such as consulting. The second limitation is related to status effects on the validity of research findings. Since all the constructs were measured based on individual perceptions, it is possible that respondents might be biased based on their position in their organization. The third limitation exists in the various kinds of KMS involved in the research, such as content management, online help publishing, knowledge portal, Help Desk, real time meeting collaboration tool, call center, and Notes database. It is understandable that each system has different features to meet business requirements, different functions to perform daily activities, and different users to please. With this degree of diversity, it might not be easy to generalize the research findings, or to draw conclusions.

Implications

In spite of the limitations noted above, results of this research can have important implications for both practice and research. Potential implications to management are summarized below:

1. Strong management support, and a collaborative and knowledge-oriented culture help in increasing KMS use. By motivating people to contribute their knowledge and wisdom to enhance information quality, and to use the system and apply the knowledge in their work, individual learning will increase.
2. Knowledge structure should reflect the pattern of use and should be refined frequently.
3. Provide more training so as to leverage the utility of the knowledge system; cover both techniques and non-technical subject areas.

Some possible future research questions include: 1) Whether system quality guarantees KMS use, or is it information quality that matters the most? 2) How users' requirements for system features and quality differ by task types, business nature, etc. 3) Can we find high KMS use in an environment lacking facilitating conditions but with strong social bonding?

Concluding Remarks

In addition to investigating the factors that enable people to learn at work, and the types of learning that occur through the use of a KMS, this study requested suggestions from KMS users regarding ways to improve system quality, information quality, and facilitating conditions so as to enhance KMS use. Based on responses from 144 KMS users, the study found that individuals learn when doing their jobs, and that individual learning can be enabled through KMS use, training/workshops/seminars, personal conversation, and meetings. This study also identifies the perceived attributes for

quality information, the features for a quality system, the conditions for supportive KMS use, and the types of learning outcomes at work.

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